RHIC-AP-31

Insertion Quadrupole Length Requirement

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Insertion Quadrupole Length Requirement for RHIC Lattice with Beta*=3-10m and Q=27.5-29.5

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In the following table, the magnet length is obtained from the assumption that the quadrupoles have the following properties:

$$B' = 57.36 \text{ T/m for Q1-Q4}$$
$$B' = 67.4 \text{ T/m for Q5-Q9}$$

The insertion of the RHIC lattice is then tuned to vary beta* from 3m to 10m at the tune of 28.826 and to vary the tune of the machine from 27.5 to 29.5 for beta* = 6m. The column 3 in the following table show the maximum factor needed to reach the tuning capability mentioned with the assumed gradient of these quadrupoles. When the factor is 1.0, the quadrupole is fully excited at beta* = 3m and q = 28.826.

Table 1. Quadrupole length requirement.

	Magnet length(m)@ beta*=3m	Factor due beta & q variation	Total magnet length(m)
LHQ1	1.50062	1.00000	1.501
LHQ2	2.42357	1.00000	2.424
LHQ3	1.13620	1.01414	1.152
LHQ4	0.97139	1.46057	1.419
LHQ5	1.03076	1.47605	1.542
LHQ6	1.20957	2.00569	2.458
LHQ7	1.58930	1.00000	1.610
LHQ8	1.37806	1.00000	1.396
LHQ9	0.99910	1.00000	1.012